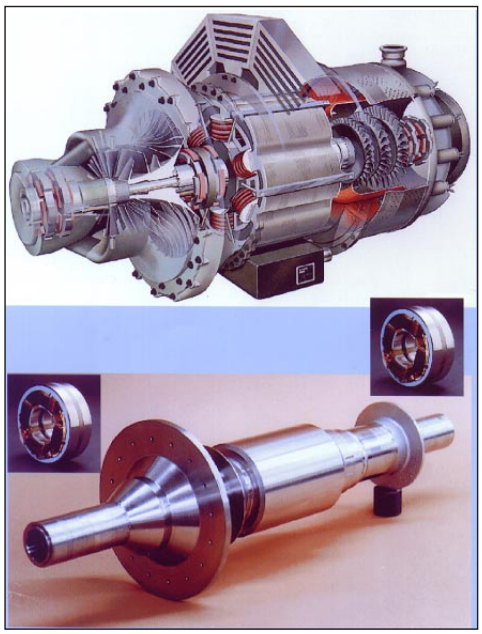
TECHNOLOGY FOR A HIGHLY RELIABLE INTEGRATED POWER UNIT DEMONSTRATED



Payoff

An integrated power unit (IPU) design, based on the elimination of the lubrication system alone, is projected to reduce aircraft power unit maintenance by more than 50 percent. Incorporation of a validated more electric aircraft IPU design approach will increase aircraft reliability, maintainability and survivability, and drastically reduce the need for aircraft ground equipment.

Accomplishment

Under a program sponsored by the Propulsion Directorate, Allied-Signal's simulated aircraft power unit (APU), supported by an oilless five axis magnetic bearing, reached a peak speed of 54,500 rpm during a control system test. This speed was achieved despite the discovery during a post-test inspection that a radial magnetic bearing was operated in a faulted condition. This test condition, however, demonstrated the fault tolerance capability of the magnetic bearing and indicated that a maximum speed in excess of 55,000 rpm would have been realized under non-faulted conditions.

Background

An integrated power unit is needed that not only provides conventional auxiliary power unit functions, but also provides instant-on emergency power at all altitude and attitude conditions, can be reliably ground started from -65°F to 120°F, and has absolutely minimal maintenance and supportability needs. In addition, this unit must be an electrically linked APU to the more electric aircraft (MEA) to provide a major source of redundant electric power to drive aircraft subsystems. Typically, subsystems are currently driven by a combination of hydraulic, pneumatic, electric and mechanical power transfer systems. The overall strategy is to develop a future IPU design for MEA which would serve as the blueprint from which two key technologies would be extracted for development. The concept of choice involves (1) a rotor/bearing technology incorporating magnetic bearings to eliminate the lubrication system requirement, and (2) an air-cooled, direct-drive switched reluctance motor/generator technology to eliminate the conventional gearbox and liquid loops. The subsystem test's success is a major step towards showing that magnetic bearings supporting a gas turbine (APU) generator rotor should be considered a viable candidate for implementing gearless/oilless technology for both aircraft and ground applications.